

THE RELATIONS OF THE PERITONEUM TO THE  
ABDOMINAL WALL, RECTUM AND BLADDER,  
WITH ESPECIAL REFERENCE TO SUPRA-  
PUBIC CYSTOTOMY, AS SHOWN  
BY FROZEN SECTIONS OF THE  
MALE PELVIS.<sup>1</sup>

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IN performing supra-pubic cystotomy, to cut into the bladder without endangering the peritoneum or doing undue violence to the connective tissue back of the pubes is the important part of the operation. Shall this be done with the bladder empty or partially filled, either alone or in connection with a distended rectum, are questions upon which all are not yet fully agreed.

For the purpose of investigating these mooted points I have undertaken, with the assistance of medical student, John S. Perekhan, a series of experiments upon a number of cadavers.

The results are shown in these drawings which are made from photographs of frozen sections of the adult male. They represent the parts as enlarged to three times their natural size.

Plate I. represents a section of a subject 40 years of age, weighing 100 pounds. It shows the normal relation of the parts, the bladder and rectum being empty. Here we see the anterior peritoneal reflection is one and one-half inches below the crest of the symphysis pubis.

<sup>1</sup>Read in the Section on Anatomy of the Ninth International Medical Congress, Washington, D. C.

Plate II. represents a section of a subject 40 years of age, weighing 140 pounds. It shows the bladder as empty and the rectum distended with fifteen fluid ounces of plaster of paris solution. Here we see the anterior peritoneal reflection is one inch below the crest of the symphysis pubis.

PLATE I.—Peritoneal Reflection.

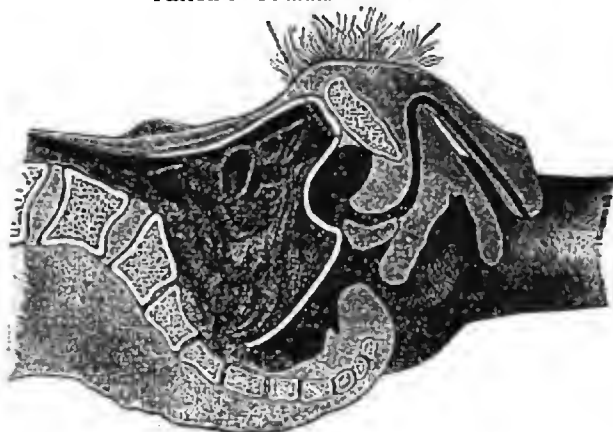


Plate III. represents a section of a subject, 35 years of age, weighing 110 pounds. It shows the rectum as empty and the bladder distended with ten fluid ounces of plaster of paris solution. Here we see the anterior peritoneal reflection is one-fourth inch below the symphysis pubis.

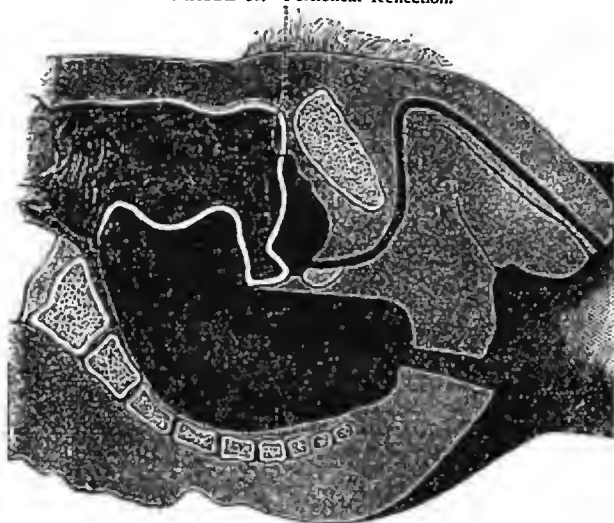
Plate IV. represents a section of a subject, 40 years of age, weighing 140 pounds. It shows the rectum as containing fifteen and the bladder ten fluid ounces of plaster of paris solution. Here we see the anterior peritoneal reflection is seven-eighths of an inch above the symphysis pubis.

You observe this white line running across the bladder in plate III. and IV.; this indicates the height to which the plaster of paris solution of ten ounces came. The space above

contained air which, I think, must have been there before the bladders were injected.

Looking at the plates with reference to the relation the anterior peritoneal reflection bears to the crest of the symphysis pubis, we observe in the normal condition of the parts, when the bladder and rectum are empty, it is one and one-half inches below ; when the bladder is empty and the rectum distended with fifteen ounces, it is one inch below ; when the rectum is

PLATE II.—Peritoneal Reflection.



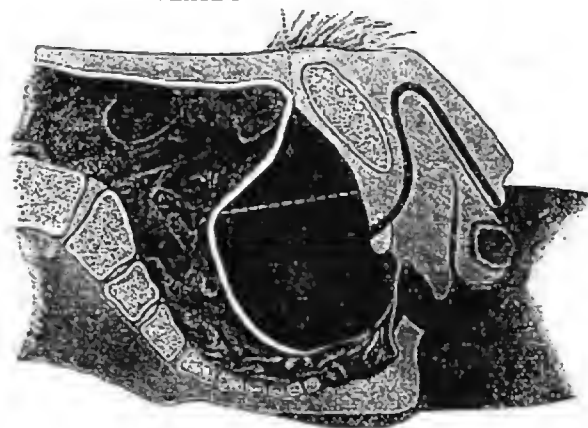
empty and the bladder distended with ten ounces, it is one-fourth of an inch below ; when the rectum is distended with fifteen, and the bladder with ten ounces, it is seven-eighths of an inch above.

Numerous experiments made upon many other subjects treated without freezing, as is seen in each of these drawings, give the same general results.

After preparing each cadaver two lines of investigation were followed. In the first a small opening was made into the abdominal cavity, and the parts examined by touch and sight. In the second, supra-pubic cystotomy was made, and the parts explored by abdominal section afterwards.

To give in detail one case under the first head will be sufficient to show in what manner our investigations were conducted.

PLATE III.—Peritoneal Reflection.



Case IV., male, 50 years of age, weighing 150 pounds, dead 24 hours; bladder empty, rectum washed out, rubber bag placed in the bowel and gradually distended with twelve fluid ounces of water.

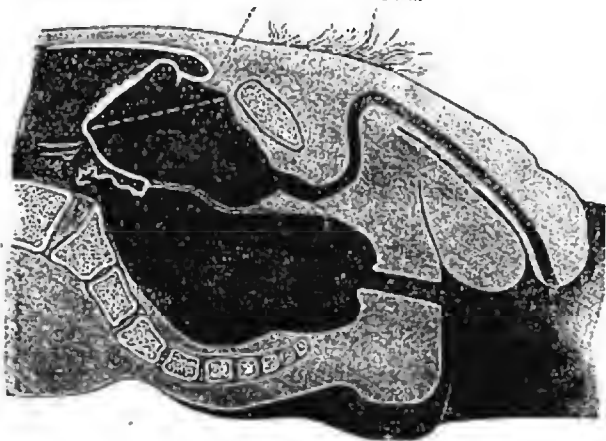
A cut was made into the abdominal cavity in the median line below the navel, just large enough to admit the index finger; the anterior peritoneal reflection was found to be at the crest of the symphysis pubis. The rectum was only moderately distended, filling up the floor and the posterior wall of the pelvis to within one inch of the promontory of the sacrum.

Next 12 ounces of water were injected into the bladder, which caused it to rise upward, nearly to the base of the sacrum, and forward against the abdominal wall, dragging the peritoneum with it to a height of three-fourths of an inch above the crest of the symphysis pubis.

Next the water was let out of the bladder which immediately settled down till the peritoneum was even with the crest.

Then the water in the rectal bag was increased from 12 to 15,

PLATE IV.—Peritoneal Reflection.



then to 24 fluid ounces; in neither case was the anterior peritoneal reflection elevated. All the fluid was contained in the rectum proper; it did not ascend to a higher point than one inch below the promontory of the sacrum. Next the abdominal opening was enlarged, and on inspection of the parts the rectum was seen to be very much distended, but there was no rupture of its fibres.

The following table gives a brief summary of this series of cases.

TABLE NO. I.

Subject.	Sex.	Weight.	No. of Fluid Ounces in Rectal Bag.	No. of Fluid Ounces in Bladder.	Relation of Anterior Peritoneal Reflection to the Crest of Symphysis Pubis, in Inches and Fraction Thereof.	Relation of Upper Dilated End of the Rectum to the Promontory of the Sacrum by Inch Measurement.
1	F	112	12	10	$\frac{1}{4}$ below	
1			22	10	even	2 below
1			22	22	$\frac{1}{4}$ above	2 below
2	M	160	12	10	even	
2			12	14	2 above	
2			0	air	3 above	
3	M	220	15	10	4 above	
3			15	16	6 above	even
3			18	16	6 above	2 above
4	M	150	12	0	even	1 below
4			12	12	$\frac{3}{4}$ above	1 below
4			18	0	even	1 below
4			24	0	even	1 below
5	M	150	6	0	$\frac{1}{2}$ below	
5			12	0	$\frac{1}{2}$ below	even
5			18	0	$\frac{1}{2}$ below	2 above
6	M	150	0	12	$\frac{1}{4}$ below	
6			6	12	even	
6			12	12	even	1 below
6			16	12	$\frac{1}{4}$ above	even
6			16	15	$\frac{1}{2}$ above	
6			16	21	2 above	
6			0	air	$2\frac{1}{4}$ above	
6			10	10		1 above
6			10	6	$\frac{3}{4}$ above	
6			10	10	$1\frac{1}{2}$ above	
7	F	190	0	air	$1\frac{1}{4}$ above	
8	F	130	12	12	$1\frac{1}{4}$ above	$\frac{1}{2}$ below
8			0	air	$2\frac{1}{4}$ above	
8			0	12	$1\frac{1}{2}$ above	
8			0	18		
21	M	125	12	0		even
21			15	0		2 above
21			15	12	$2\frac{1}{4}$ above	
21			23	0		3 above, burst rectum.

In the second series of cases supra-pubic cystotomy was first made and the parts inspected afterward.

The following case is offered in illustration: Subject XIII, male, of good muscular development, 40 years of age, weighing 160 pounds, bladder empty; the rectum was washed out, and 12 fluid ounces of water were injected into the rectal bag, and 10 ounces into the bladder. Supra-pubic cystotomy was made without seeing or injuring the peritoneum, also without disturbing the space between the bladder and pubes.

The manner of operating was as follows: An incision was carried from the crest of the pubes upward in the median line three inches, linea alba exposed, then a cut between the pyramidalis muscles exposed the transversalis fascia; a small nick was made into this, opposite to the crest of the pubes, and then enlarged upward an inch; the end of the index finger was put into the wound and the underlying fatty tissue hooked up; a little scraping below the fingers revealed the bluish appearing bladder, the apex of which could be felt  $2\frac{1}{2}$  inches above the crest; the bladder, only moderately distended, was easily picked up with common dissecting forceps, and an incision an inch in length made into the anterior surface, about one ounce of fluid escaping; left index finger, hooked into the bladder, felt its apex one inch above the upper end of the cut into it.

The following table is a brief summary of the cases operated upon without seeing or injuring the peritoneum:

TABLE NO. 2.

Subject.	Sex.	Age.	Weight.	Fluid Quantity in Rectal Bag.	Fluid Quantity in Bladder.	Relation of the Apex of the Bladder to the Crest of the Pubes, in Inches and Fractions Thereof.
9	M	45	160	0	10	$\frac{1}{2}$ below
10	M	28	150	0	0	$\frac{1}{2}$ below
11	M	50	175	0	air 10 oz	$2\frac{1}{2}$ above
12	F	30	110	14	8	$1\frac{1}{2}$ above
13	M	40	160	12	10	$2\frac{1}{2}$ above
14	M	25	160	0	air 10 oz	2 above
15	M	35	125	12	6	$2\frac{1}{2}$ above
20	M	40	160	12	8	1 above
23	F	50	110	15	12	3 above
24	M	40	120	12	8	3 above

In the last table we give the relation of the apex of the bladder to the crest of the pubes; in the first, the relation of the anterior peritoneal reflection to the same point. It must be remembered that the apex of the bladder and the peritoneal reflection are not always on the same level; in moderate distention of the bladder, the peritoneum passes down on its anterior surface a variable distance, depending upon the degree of distention and the firmness with which the bladder is pressed against the abdominal wall.

When the apex of the bladder is two inches above the crest, and the bladder pressed firmly against the abdominal wall, the peritoneal reflection is not more than three-fourths of an inch above the same point. With this degree of distention, however, the peritoneum is so loosely attached that it and its subjacent fatty layer can easily be slipped up without doing violence to either.



Rectal Bag.

The rectal bag used, which is shown in the cut, is made of pure rubber, with rather thin walls; when empty it is six inches in length by two and one-half inches in width; one end is somewhat rounded, to the other is attached a rubber tube, twelve inches long, for convenience in filling.

To introduce the bag, it is first oiled and then bunched together and folded over the index finger, when it is easily introduced just within the internal sphincter; a measured quantity of water is gradually and slowly injected with a bulb syringe.

As the result of these investigations the following conclusions are submitted:

1. In the normal condition, the bladder and rectum being empty, the apex of the bladder and peritoneal reflection are a little above the arch of the pubes.
2. In moderate distention of the bladder the anterior peritoneal reflection is below the apex; with the same degree of



distention and the bladder pressed against the abdominal wall, the peritoneum ascends higher.

3. Supra-pubic cystotomy can be most easily and safely performed when the bladder is lifted from the pelvic floor and moderately distended against the abdominal wall.

4. Distention of the rectum alone elevates the base of the empty bladder, but does not raise materially the vesico-abdominal fold of peritoneum.

5. Distention of the bladder alone, in thin subjects particularly, requires relatively a greater amount of fluid to elevate the peritoneal reflection. The bladder is not crowded against the abdominal wall, but rather falls away from it.

6. Moderate distention of both rectum and bladder meets the indication the best; from 10 to 12 ounces in the rectal bag and 8 to 10 in the bladder is generally enough, and seems to be a safe quantity to use.

7. Dilatation of the rectum first and the bladder afterward lifts the peritoneal reflection the highest.

8. The object of the rectal bag is to elevate the distended bladder and press it against the abdominal wall and so crowd up the peritoneum.

9. To meet the indication the gut should be dilated from the anus to near the promontory of the sacrum.

10. The rectal bag should be sausage-shaped, of rather thin rubber, rather than pyriform and thick, for the thinness enables it to follow up the gut, and the shape makes uniform pressure throughout the entire length.

11. In a very fleshy subject, with a flabby or pendulous belly, the bladder is relatively freely movable. In such a case it will easily rise out of the pelvis against the abdominal wall, when alone distended with a moderate quantity of water; the rectal bag may then be safely dispensed with.

12. Air, injected into the bladder of a subject, lifts the bladder and its peritoneal reflection out of the pelvis better than water; see cases ii, vii, xi and xiv.

13. In one case the gut was ruptured opposite the promontory of the sacrum with 23 ounces in the rectal bag (case xxi); in no case was the bladder ruptured.

14. In the cases reported an average of 14 ounces in the rectal bag and 12 in the bladder elevated the anterior peritoneal reflection an average of  $1\frac{1}{2}$  inches above the crest of the pubes; the apex of the bladder was one inch higher.

In 25 cases reported by Dr. Helmuth in his monograph on suprapubic lithotomy, when the bladder alone was injected, the average quantity of water in each was 27 ounces, the peritoneum was lifted 2 and the apex of the bladder 4 inches above the crest of the pubes. In five of these cases rupture of the bladder occurred with an average of 59 fluid ounces.<sup>1</sup>

#### DETAILS OF THE EXPERIMENTS.

The first thing done with each subject was to empty the

<sup>1</sup>In the *ANNALS OF SURGERY*, Vol. iii, page 116, February, 1886, is an abstract of an article on Displacement of the Urinary Bladder by Tamponing the Rectum by Dr. Fehleisen. Allusion is here made to former investigators—Braune, Garson, Petersen, Mannheim, and Bergmann. Fehleisen placed a glass plate on the flat surface of a frozen median section and marked out the exact relations. Four, large, colored lithographs illustrate his results. In the first, the rectum was empty, and the bladder distended with nine ounces of fluid; the anterior peritoneal reflection was one-fifth of an inch above the crest. In the second the rectum was distended with sixteen and the bladder with six and three-fourth ounces of fluid. The anterior peritoneal reflection was one and a half inches above the crest. In the third the rectum was empty and twenty-one ounces were in the bladder. The anterior peritoneal reflection was three-fourths of an inch above the crest. In the fourth the bladder was distended with twelve and a half and the rectum with seventeen ounces. The anterior peritoneal reflection was three and one-fourth inches above the crest. Petersen concludes as the result of ten measurements, the bladder and rectum being empty, that the anterior peritoneal reflection is one and one-sixth inches below the crest. In ten other experiments, rectum empty and bladder distended with twenty and one-fourth ounces of fluid the anterior peritoneal fold was elevated above the crest, but little more than one-third of an inch. Petersen advises to first inject the bladder, then the rectum. Fehleisen reverses the order and recommends fifteen to sixteen ounces for the rectum and then eight to ten for the bladder. My own investigation of both methods convinces me that the latter plan is the best. The bladder can be lifted easier and higher by first filling the rectal bag and afterwards the bladder.

The general conclusions obtained by all these investigators coincides very closely indeed with my own. It is but justice to myself to say that at the time my own experiments were made I was not acquainted with the conclusions of others who had investigated the same subject. It is a source of gratification to me to see how closely we have all agreed in the practical features of the work, namely, that the anterior peritoneal reflection is lifted the highest when both rectum and bladder are moderately distended.

bladder and wash out the rectum. Fluid ounces of water were used to distend the gut by means of the rectal bag; the bladder was directly injected, a bulb syringe being used.

The relation of the anterior peritoneal reflection to the crest of the symphysis pubes is given by inches; also the relations of the upper end of the distended rectum to the promontory of the sacrum is given by the same measurement.

The following are the cases operated upon:

SUBJECT I.—Female in good flesh, 30 years of age, weighing 112 pounds.

*Experiment 1.*—First injected 12 ounces into the rectal bag, then 10 ounces into the bladder; the peritoneal reflection was  $\frac{1}{4}$  of an inch below crest; bladder only moderately distended.

*Experiment 2.*—The amount of fluid in the bladder remaining the same, *i. e.*, 10 ounces, the fluid in rectal bag was increased from 12 to 22 ounces; the peritoneal reflection was even with the crest, and the upper end of the distended rectum was 2 inches below the promontory of the sacrum.

*Experiment 3.*—The amount of fluid in rectal bag remaining the same, *i. e.*, 22 ounces, the fluid in the bladder was increased from 10 to 22 ounces; the peritoneal reflection was  $\frac{1}{4}$  of an inch above the crest; both bladder and rectum seemed to be distended to their utmost capacity: neither viscus was ruptured. Notwithstanding the unsafe quantity of water in the rectal bag and bladder, 22 ounces, the peritoneum was lifted only  $\frac{1}{4}$  of an inch. I think this is explained when we see that the rectum was not dilated upward beyond a point 2 inches below the promontory of the sacrum; the bladder bulged backward over the upper end of the rectal bag. The bladder was not dilated high enough to throw the bladder against the abdominal wall. It is not so much the lifting of the base of the bladder that is required, as the throwing of the whole bladder forward; a high dilatation of the rectum does this best.

SUBJECT II.—Male, negro, well developed, weighing 160 pounds, dead 20 hours from typhoid fever; abdomen considerably bloated and tympanitic, not, however, because of post-mortem changes.

*Experiment 1.*—First injected 10 ounces into the bladder, then 12 ounces into the rectal bag; the peritoneal reflection was even with the crest.

*Experiment 2.*—The fluid in the rectal bag remaining the same, *i. e.*, 12 ounces, the fluid in the bladder was increased from 10 to 14 ounces; peritoneum elevated 2 inches.

*Experiment 3.*—The bladder and rectum were both emptied, the rectum remaining empty; the bladder was distended moderately with air; peritoneum elevated 3 inches.

SUBJECT III.—Male, large, very fat, pendulous abdomen, 25 years of age, weighing 220 pounds, dead 24 hours.

*Experiment 1.*—First injected 15 ounces into the rectal bag, then 10 ounces into the bladder; peritoneum elevated 4 inches; bladder only slightly distended.

*Experiment 2.*—The quantity of water in the rectal bag remaining the same, *i. e.*, 15 ounces, the water in the bladder was increased from 10 to 16 ounces; peritoneum elevated to the navel, bladder only moderately distended, rectum distended to the promontory of sacrum.

*Experiment 3.*—The water in the bladder remaining the same, *i. e.*, 16 ounces, the water in the rectal bag was increased from 15 to 18 ounces. Rectum dilated to a point 2 inches above the promontory of the sacrum; rectum not over-distended; no fibres ruptured.

SUBJECT IV.—Male, 50 years of age, weighing 150 pounds; dead 24 hours.

*Experiment 1.*—Injected 12 ounces into the rectal bag, peritoneum even with the crest; rectum moderately distended to one inch below the promontory of the sacrum.

*Experiment 2.*—The rectal bag holding 12 ounces, 12 ounces were injected into the bladder; peritoneum elevated  $\frac{3}{4}$  of an inch.

*Experiment 3.*—Bladder emptied, water in rectal bag increased from 12 to 18, then to 23 ounces; rectum very much distended up to a point one inch below the promontory of the sacrum.

SUBJECT V.—Male, well developed, 40 years of age, weighing 150 pounds, dead 24 hours.

*Experiment 1.*—Injected first 6, then 12, then 18 ounces into rectal bag; peritoneum not materially changed in either case; when 12 ounces were in rectal bag, the rectum was dilated to the promontory of the sacrum; when 18 ounces were in it, it was dilated to a point 2 inches beyond. No experiments were made on the bladder, owing to a stricture of the urethra.

SUBJECT VI.—Male, 40 years of age, weighing 150 pounds, dead 36 hours.

*Experiment 1.*—Injected 12 ounces into the bladder; moderately distended; peritoneal reflection one-fourth of an inch below crest.

*Experiment 2.*—12 ounces remaining in the bladder, 6 ounces were injected into the rectal bag; peritoneum even with the crest; 6 ounces more injected into the rectal bag; did not materially change the peri-

toneum; rectum distended to within one inch of the promontory of the sacrum.

*Experiment 3.*—12 ounces remaining in the bladder, the water in the rectal bag was increased from 12 to 16 ounces; rectum distended to the promontory of the sacrum; peritoneum elevated one-fourth of an inch above crest.

*Experiment 4.*—16 ounces remaining in the rectal bag, the water in bladder was increased from 12 to 15 ounces; peritoneum one-half inch above crest.

*Experiment 5.*—16 ounces remaining in the rectal bag, water in bladder increased from 5 to 21 ounces; peritoneum elevated two inches.

*Experiment 6.*—Water let out of the rectal bag; bladder with its 21 ounces sinks into the pelvic cavity; peritoneum three-fourths of an inch above crest.

*Experiment 7.*—Both bladder and rectum being empty, bladder was moderately distended with air; peritoneum two and one-fourth inches above crest.

*Experiment 8.*—Rectum and bladder being empty, 10 ounces were injected into rectal bag, which distended it to a point one inch below promontory of sacrum. No effect on peritoneal reflection.

*Experiment 9.*—10 ounces remaining in the rectum, 6 ounces were injected into the bladder; peritoneum elevated three-fourths of an inch above crest. Water in bladder increased to 10 ounces; peritoneum elevated one and one-fourth inches.

SUBJECT VII.—Female, very fleshy and flabby, with pendulous abdomen, 50 years of age, weighing 190 pounds, dead 40 hours.

*Experiment 1.*—Rectum empty, bladder moderately distended with air; peritoneum one and one-half inches above the crest. On attempting to squeeze the air out of bladder through a small opening in the abdominal walls, the bladder was ruptured. It had not been over-distended with air.

SUBJECT VIII.—Female, 20 years of age, 130 pounds weight, in good flesh, accidentally killed 40 hours before.

*Experiment 1.*—Injected 12 ounces into the rectal bag, also same amount into the bladder; peritoneum elevated one and one fourth inch above crest; rectum distended to a point one-half inch below promontory of sacrum.

*Experiment 2.*—Bladder and rectum emptied; bladder distended with air till clear resistance was offered to the bulb of a Davidson's syringe. Apex of bladder within two inches of navel; peritoneum lifted two and one-fourth inches above crest; bladder not ruptured.

*Experiment 3.*—Bladder and rectum emptied; injected 12 ounces into the bladder; peritoneum lifted one and one half inches above crest.

*Experiment 4.*—Rectum empty; 18 ounces injected into the bladder; elevated apex of the bladder one-half way to navel; 30 ounces brought it to within one inch of navel; bladder very tight, not ruptured at 36 ounces.

SUBJECT IX.—Male, 45 years of age, weight 160 pounds; dead 36 hours.

*Experiment 1.*—Rectum empty, bladder distended with 10 ounces; made suprapubic cystotomy without seeing or injuring peritoneum; apex of bladder one-half inch below crest; picked up apex of bladder with forceps; when incised there escaped not more than two drachms of blood; bladder very loosely distended.

SUBJECT X.—Male, 28 years of age, weighing 150 pounds; 20 hours dead.

*Experiment 1.*—Bladder and rectum being empty, made suprapubic cystotomy without seeing or injuring the peritoneum; apex of bladder one-half inch below crest. In operating the cellular tissue in front of bladder was much more disturbed than if the bladder had been distended.

SUBJECT XI.—Male, 50 years of age, general anasarca, moderate ascites, weighing 175 pounds, 15 hours dead.

*Experiment 1.*—Injected into the bladder 8 bulbs of air from a Davidson syringe, moderate distention equivalent to 10 ounces of water, made suprapubic cystotomy without seeing or injuring the peritoneum; apex of bladder two and one-half inches above crest; peritoneum at least one inch above crest; bladder loosely distended.

SUBJECT XII.—Female, 30 years of age, 110 pound weight, dead 36 hours.

*Experiment 1.*—Injected 14 ounces into rectal bag, also 8 ounces into the bladder. Made suprapubic cystotomy without seeing or injuring the peritoneum; apex of bladder one and one-half inch above pubes and against abdominal wall.

SUBJECT XIII.—Male, of good muscular development, 40 years of age, weighing 160 pounds.

*Experiment 1.*—Injected 12 ounces into the rectal bag, also 10 into the bladder. Made suprapubic cystotomy in the usual way without injuring the parts, or seeing the peritoneum. Apex of bladder 2½ inches above crest, and against the abdominal wall, rectum distended to within an inch of promontory of sacrum.

SUBJECT XIV.—Male, 25 years of age, good muscular development, weighing 160 pounds.

*Experiment 1.*—8 bulbs of air from a Davidson's syringe distended the rectal bag as much as 10 ounces of water. With the rectum empty, bladder distended with 8 bulbs of air, apex of bladder rose 2 inches above the crest, made suprapubic cystotomy without seeing or injuring the peritoneum. The bladder was only moderately distended, and by opening it the cellular tissue was disturbed considerably; bladder was not held against the abdominal wall.

SUBJECT XV.—Male, 35 years of age, rather small, but well developed, weighing 125 pounds.

*Experiment 1.*—Injected 12 ounces into the rectal bag, and 6 into the bladder. Made suprapubic cystotomy without seeing or injuring the peritoneum; apex of bladder  $2\frac{1}{2}$  inches above crest and against abdominal wall, loosely distended; not more than half an ounce of water escaped when it was opened. No disturbance of cellular tissue back of pubes.

SUBJECT XVI.—(See plate No. 1.) Male, 35 years of age, weighing 100 pounds, bladder emptied, rectum washed out, put in the refrigerator of Rush Medical College. Seven days later, removed to the dissecting room, and made a vertical section with a saw. Anterior peritoneal reflection  $1\frac{1}{2}$  inches below crest.

SUBJECT XVII.—(See plate No. 3.) Male, 35 years of age, 110 pounds weight, rectum washed out; bladder emptied, injected into the bladder 10 fluid ounces of plaster of Paris solution, and put into the refrigerator.

Seventeen days later, a section was made; anterior peritoneal reflection  $\frac{1}{2}$  inch below crest, bladder not more than four-fifths full; air chamber above; air must have been there at the time of injection.

SUBJECT XVIII.—(See plate No. 4.): Male, 40 years of age, 140 pounds weight, bladder emptied, rectum washed out, injected into the rectal bag 15 and into the bladder 10 fluid ounces of plaster of Paris solution, put in refrigerator. On section seven days later anterior peritoneal reflection seven-eighths of an inch above crest of pubes, air space above level of plaster.

SUBJECT XIX.—(See plate No. 2.) Male 30 years of age, 140 pounds weight. Bladder emptied, rectum washed out, injected 15 ounces of plaster of Paris solution into the rectal bag, put in refrigerator. Fourteen days later, made section, anterior peritoneal reflection one inch below crest.

SUBJECT XX.—Boy 5 years of age, 30 pounds weight, bladder

emptied, rectum washed out, put in a refrigerator. Twenty-three days later, made section, anterior peritoneal reflection one-fourth inch below crest of symphysis pubis.

SUBJECT XXI.—Male, 40 years of age, 125 pounds weight.

*Experiment 1.*—12 ounces, injected into the rectal bag, distended the rectum to promontory of sacrum; water increased to 15 ounces, rectum distended to a point 2 inches beyond the promontory of the sacrum.

*Experiment 2.*—15 ounces remaining in the rectal bag, 6 ounces were injected into the bladder, peritoneum even with the crest; water in the bladder increased to 12 ounces, peritoneum elevated two and a half inches.

*Experiment 3.*—Water in the bladder let out, water in the rectal bag increased from 15 to 23 ounces, rectum distended to a point 3 inches beyond the promontory of the sacrum, muscular fibres gave way in a longitudinal direction on each side of the median line of the gut, and opposite to the promontory of the sacrum.

SUBJECT XXII.—Male, 40 years of years, 160 pounds weight, injected 12 ounces into the rectal bag, 8 into the bladder. Made a cut into the bladder without seeing or injuring the peritoneum. Apex of bladder 1 inch above crest, rectum distended to the promontory of sacrum. In this case considerable trouble was experienced in keeping the bag in the rectum on account of the lax and distended anus. When 6 ounces of water were injected, the bag began to bulge from the anus, and came out altogether, when 8 ounces were in. Reintroduced the bag and applied a compress to the perineum while 12 ounces were injected; then injected 8 ounces into the bladder. When the bladder was exposed, it was not distended, was very lax and fell away from the abdominal wall. It was opened with difficulty and considerable more laceration of the connective tissue back of pubes than was necessary had the bladder been comfortably filled and pressed against the abdominal wall. In the latter condition, as I have frequently observed, the bladder and abdominal wall are practically inseparable, the bladder lies at the bottom of the wound and bulges into it slightly when the transversalis fascia is opened: absolutely no separation of the connective tissue about the bladder made in such a case.

Let out the water from the bladder, increased the water in the rectal bag to 20 ounces, when the bag burst; the rent took place close to where the injecting pipe enters the bag; a round piece as large as the little finger-nail was completely torn out, a compress was held against the anus at the time and there was considerable pressure felt in the sy-



ringe! Trying to burst the gut with one hand in the abdomen I felt the large bowel distending two inches beyond the promontory of the sacrum. The gut was not ruptured.

SUBJECT XXIII.—Female, 50 years of age, 110 pounds weight, dead 5 hours, body yet warm. Injected 15 ounces into the rectal bag, and 12 ounces into the bladder; cut into the bladder without seeing or injuring the peritoneum. Apex of bladder 3 inches above crest, bladder only moderately distended, bag close against the abdominal wall; drew bladder into the wound and opened it; not one ounce of water escaped, showing the bladder was not much distended or pressed upon by the dilated rectum. Rectum distended to promontory of sacrum, and against the arch of the pubes tight enough to prevent the water in the bladder from escaping at the urethra. When the water was let out of the bladder, its base was easily explored with the index finger; it was not more than 2 inches below the cutaneous surface.

*Experiment 2.*—Put the bag into the vagina and injected 6 ounces into it. This dilated the vagina completely, but would have had no effect on the distended bladder, I think, or the distention did not follow up the hollow of the sacrum: the distention did not pass behind the bladder.

SUBJECT XXIV.—Male, 40 years of age, 120 pounds weight.

*Experiment.*—Injected 12 ounces into the rectal bag, and 8 into the bladder. This caused a slight bulging of the bag from the anus, and the bladder stood up well defined; there was considerable resistance felt in the syringe in filling the bag, but little or none on distending the bladder. Cut into the bladder, its apex was 3 inches above the crest, bladder lay close to the abdominal wall, and seemed to be fully distended: on opening the transversalis fascia the bladder bulged into the wound; 4 ounces gushed out when the bladder was opened, showing the bladder had been tightly compressed, rectum distended to promontory of sacrum.